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(19) (CA) APPLICATION FOR CANADIAN PATENT (12)

(54) Weldable Drawn Plastic Strip and Structures Produced from Such Strip

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Notice: This application is as filed and may therefore contain an incomplete specification.

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Abstract

Drawn, weldable plastic strip, characterised in that it comprises at least one surface, in which surface are embedded absorption particles which have a distinctly higher absorption capacity for electromagnetic radiation within the frequency range from 10 to 50,000 MHz than the plastic of which the strip is made. The strip can be welded to itself by its ends via the surface layer containing absorption particles. Mats can be made from crossed strips which are welded together at their crossing points by electromagnetic radiation.

Drawn, weldable plastic strip and structures made therefrom

Description:

The invention concerns a drawn, weldable plastic strip and structures made therefrom.

Strips of this kind are known for example from DE-A-2 246 051 for the manufacture of mats. The strips consist of two polymer layers with different melting points, one polymer forming the strength carrier and therefore being drawn, while the other polymer with the lower melting point serves to weld the strips. Choice of the plastics to be used is problematic. During subsequent drawing of these at least two-layer strips, tearing or even peeling of the layer(s) provided for welding can occur. The choice of suitable plastics is moreover limited to a few pairs, because as a rule only those pairs of plastics which adhere to each other well and in which the difference between the two melting points is as great as possible are considered. If the difference in melting points is selected too small, deorientation of the polymer which guarantees the strength of the strip and hence a reduction in strength of the strip occur. This is all the more so, the smaller the difference in melting points.

Within the meaning of the present invention, the term strips is intended to include all those structures which have a distinctly greater dimension in one direction than in the other two directions extending perpendicularly to the first direction. In this respect, by strips within the meaning of the invention are meant for example monofilaments, multifilaments or bands.

It is the object of the present invention to eliminate the above-mentioned drawbacks at least to a large extent. Strips which can be welded together without great expenditure are to be provided. When welding such strips, they are to suffer the minimum possible loss of strength.

This object is achieved in a drawn, weldable plastic strip by the fact that it comprises at least one surface,

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in which surface are embedded absorption particles which have a distinctly higher absorption capacity for electromagnetic radiation within the frequency range from 10 to 50,000 MHz than the plastic of which the strip is made.

The strips according to the invention can be made by the usual methods in the manufacture of two-layer strips, wherein however the finished strip now has the same plastic over the whole cross-section. Drawing to increase the strength and modulus of the strip is therefore possible without risk of tearing and peeling. During welding, owing to the embedded absorption particles, almost only the region containing these particles is melted, so that outside the region containing the absorption particles deorientation of the strips is largely or even usually completely absent, so that the strength of the strips which they are to exhibit after welding can be predetermined substantially more precisely than with the strips known today.

The embedding of absorption particles in the surface of plastics is of course already known (EP-A-0 274 364), but this involves mouldings in which the structure inherent in the mouldings and thus their properties are unimportant. The aim is merely to provide a more economical welding method. The merit of the present invention is having recognised that in employing the known method the strength of the strips welded together can be predetermined quite well.

The strips according to the invention are distinguished in particular if the absorption particles have a conductivity which is at least three times as high, in particular at least ten times as high, as the conductivity of the plastic of which the strip is made.

Preferably the strip has a thickness which is at least ten times as great as the layer thickness of the surface layer containing the absorption particles.

Strips which consist of one or more monofilament(s) or multifilament thread(s) have particularly proved themselves. Strips of rectangular cross-section have

particularly proved themselves, the width of the rectangle forming the cross-section being at least five times as great as the height of this rectangle.

The strips according to the invention are particularly suitable as plastic packing straps which in use are welded together at their ends. In particular in the case of packing straps it is important that the strength thereof is not weakened in the region of the weld. In this respect the subject of the invention is also a strip which is distinguished by the fact that it is welded to itself by its ends via the surface layer containing the absorption particles. In this case it is recommended that both surface layers of the strip contain absorption particles. Welding is in this case carried out by pressing together the two ends of the strip and subjecting them to electromagnetic radiation within the frequency range in which the absorption particles absorb a particularly large amount of energy. In this case as a rule it is sufficient if the strips for carrying out welding are exposed for about 10 to 100 milliseconds to the electromagnetic radiation for example at the officially permitted frequencies of 2.45 or 5.8 GHz.

The strips according to the invention are also especially suitable for the manufacture of a mat as described in DE-A-2 246 051. The mat according to the invention is distinguished by the fact that it consists of crossed strips which are welded together at their crossing points, and that it contains strips which are welded together by their surface layer containing the absorption particles. If the strips are laid one on top of the other after the fashion of a swath, it is sufficient if at least in one layer there are strips according to the invention which comprise the surface layer containing the absorption particles as a contact layer with the other strips laid on top of these strips. Here too, by pressing and subjecting to high-frequency irradiation, welding can be carried out easily in such a way that after welding it is almost only

in the region of the layer containing the absorption particles that there is a polymer structure corresponding to welding. It is recommended, to increase the strength of the mat, that at least the majority, preferably all strips be provided with layers containing absorption particles and inlaid or arranged on both sides (for example in the case of multi-layer mats). If the mats are made from the strips in the form of a woven fabric, the strips advantageously have absorption particles in their surface layers on both sides. The surface layer containing the absorption particles must only have a thickness of a few tenths of a millimetre or less, for example 10 to 40 μm. After carrying out welding, these mesh mats have almost the same strength as the sum of the strengths of the strips or bands located in one direction. In this case it is sufficient if the bands for carrying out welding are exposed for about 10 to 100 milliseconds to the electromagnetic radiation for example at 2.45 or 5.8 GHz.

The mats according to the invention are especially suitable for soil stabilisation, for example on slopes, as a foundation for dumps or for the track substructure for railway vehicles. To fix the edges of this mat in the earth, the strips may at their ends comprise loops which can be made easily by turning back the strips according to the invention at their ends and then joining the end of the respective strip to the strip itself for example again by electromagnetic radiation in such a way that a loop is formed. The mat according to the invention is therefore also distinguished by the fact that at least some of the strips forming the mat comprise loops at their ends.

Welding of the strips according to the invention takes place within a very short time, which as a rule is distinctly below one second. Conversion of the electromagnetic radiation to heat takes place almost exclusively in the region in which the absorption particles are embedded, so that only this region of the plastic is converted to molten material, so that the region of the

weld joint can easily be predetermined by selection of the thickness of the surface layer containing the absorption particles. By the depth of embedding the absorption particles, therefore, the region which is used to produce the weld joint can be determined fairly accurately, while the other regions of the strip undergo slight heating at the most, so that the state of orientation and/or degree of crystallisation thereof can be obtained.

Use of the strips according to the invention is therefore particularly recommended whenever for example a high strength of the plastic obtained by orientation is desired in welded structures consisting of strips, as the welded region in which, as is known, deorientation takes place due to welding can be predetermined fairly accurately, so that the strength of a welded construction provided by the strips according to the invention can be adjusted.

The increase in strength of the plastic strips is achieved in a known manner by drawing the strips, as a result of which a distinct increase in orientation of the plastic polymer is caused.

A critical factor for localisation of the weld in carrying out welding is the quantity of absorption particles embedded. Here it has proved to be particularly advantageous if the absorption particles are embedded in the surface of the elements to be welded in such a quantity that the distance between adjacent absorption particles is smaller than the thickness of the surface layer which contains the absorption particles. The smaller the distance is between adjacent absorption particles, the more the generation of heat is concentrated on the surface layer which contains the absorption particles. Here it is particularly favourable if the surface layer with the embedded absorption particles has a conductivity which is at least three times as high as the conductivity of the plastic from which the strips are formed. The object set according to the invention is achieved particularly favourably if the absorption particles have a conductivity

which is at least ten times as high as the conductivity of the strip. In this case, in particular soot particles, magnetite powder and/or metal powder have proved to be particularly favourable as absorption particles. Other suitable absorption particles are described in WO 91/19 036. The welded region can be predetermined easily by the thickness of the surface layer containing the absorption particles. To carry out welding, therefore, thin surface layers containing the absorption particles are preferred. The layer thickness for larger strips is preferably selected in the region of a few millimetres.

Embedding of the absorption particles can be achieved for example by the fact that embedding of the absorption particles takes place in such a way that the absorption particles are applied in a thin layer to the surface of the strip to be welded and pressed into the surface. For this purpose it is particularly favourable if first a film is made, then the absorption particles are pressed in and then strips are cut out of the film. Pressing in can take place for example by rollers.

The strips according to the invention are obtainable particularly favourably by multi-component spinning nozzles in which basically the same polymer is supplied to all the nozzle channels, wherein however absorption particles are mixed with at least one polymer stream which is provided for forming an outer layer. Depending on whether one or more surfaces of the strip are to be used for welding, surface layers with absorption particles can be provided accordingly.

If according to the invention strips are to be welded on one side only, these strips need only a two-layer structure, whereas in the case of two-sided welding, naturally two surfaces should contain absorption particles, on account of which a three-layer structure is suitable therefor. In particular if the strips are monofilaments, bicomponent threads are suitable for example in a side-by-side arrangement, but in particular in a cladded core

arrangement, wherein however both components contain the same polymer and absorption particles have been mixed in only in the layer provided for welding.

Claims

1. Drawn, weldable plastic strip, characterised in that it comprises at least one surface, in which surface are embedded absorption particles which have a distinctly higher absorption capacity for electromagnetic radiation within the frequency range from 10 to 50,000 MHz than the plastic of which the strip is made.

2. Strip according to claim 1, characterised in that the absorption particles have a conductivity which is at least three times as high as the conductivity of the plastic of which the strip is made.

3. Strip according to claim 2, characterised in that the absorption particles have a conductivity which is at least ten times as high as the conductivity of the plastic of which the strip is made.

4. Strip according to claim 1, 2 or 3, characterised in that the thickness of the strip is at least ten times as great as the layer thickness of the surface layer containing the absorption particles.

5. Strip according to one or more of claims 1 to 4, characterised in that it consists of at least one monofilament in the surface of which absorption particles are integrated.

6. Strip according to one or more of claims 1 to 4, characterised in that it consists of at least one multifilament thread.

7. Strip according to one or more of claims 1 to 6, characterised in that it has a rectangular cross-section, the width of the rectangular cross-section being at least five times greater than the height thereof.

8. Strip according to one or more of claims 1 to 7, characterised in that it is welded to itself by its ends via the surface layer containing the absorption particles.

9. Mat consisting of crossed strips which are welded together at their crossing points, characterised in that it contains strips according to one or more of claims 1 to 7 which are welded together by their surface layer containing the absorption particles.

10. Mat according to claim 9, characterised in that at least some of the strips forming the mat comprise loops at their ends.